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ABSTRACT

Subjective story structures generated by 52 hearing impaired college students were compared with well-known theoretically derived structures and with structures produced by comparable hearing Ss. Ss were instructed to read each of four simple narratives and sort the sentences into groups that made up part of the story. Results of cluster analysis are reported for each study. Similarities and differences with deaf and hearing Ss were revealed, similarities regarding the outer boundaries of major clusters and differences pertaining to the internal structuring of major clusters. Among conclusions suggested were that deaf readers appear to employ an internal structure or organization consistent with that of hearing Ss and that of theoretically derived structures; and that, although deaf and hearing Ss appear to share similar outer boundaries for the major clusters, the internal organization of those same clusters appears to be different. (CL)

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Subjective Story Structure in Deaf Adults[1]

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The notion of schemata represent a pivotal construct in the area of prose learning. Although several definitions of schemata have been proposed, it is generally agreed that they are basically abstract, prototypical structures that serve as exemplars for concepts, sets of concepts, and the relationships among those concepts (cf. Thorndyke and Hayes-Roth, 1979; Thorndyke and Yekovich, 1980).

Schemata have been described in two interdependent ways by theorists concerned with prose learning. One the one hand, story grammarians have essentially focused on the schematic structure of narratives (e.g., Rumelhart, 1975; Thorndyke, 1977). These efforts have been concerned with describing the stereotypical structure of simple stories, and determining the extent to which this structure influences human comprehension and memory (e.g., Thorndyke and Yekovich, 1980; Yekovich and Thorndyke, in press). Schemata are the primary unit of structure in these concerns and typically represent in hierarchical fashion, the dependencies among the various elements in the plot organization of the stories.

On the other hand, schemata have also been used to describe elements of human memory vital to the understanding process (e.g., Kintsch and van Dijk, 1978). In these efforts, schemata comprise internal expectations, frames, scripts, clusters of knowledge, or mental scaffolding that a reader employs to encode events, episodes, relationships, and sequences found in text (e.g., Anderson and Pichert, 1978). These schemata are sometimes differentiated from story grammar schemata because the former represent organizations within the reader that are used in interpreting incoming

information rather than in describing the stereotypical structure of the narrative itself. While it has been shown that the well-formedness of a narrative affects its memorability (Thorndyke, 1977), and that the activation and use of memory schemata are influenced by text structure variables (Thorndyke and Hayes-Roth, 1979), little information has been compiled on the relation between theoretically defined schemata (i.e. story grammar descriptions) and the mental representations of narratives internal to the reader. That is, do the hierarchical structures generated by story grammar rules match or duplicate those mental frameworks for stories that reside within the reader? This is an important question for if it can be shown that narrative schemata in readers match the story structures generated by grammars, an important level of construct validity is accorded the grammars. However, a means of determining the mental frameworks that reside within the learner must first be established. A recent study reported by Pollard-Gott, McCloskey, and Todres (1979) has addressed just this issue.[2] Their study, to be described below, reported both a method for determining the structure of stories as perceived by subjects (subjective or empirical structures) and provided a comparison of these subjective structures with story structures generated by story grammar production rules (theoretical structures).

Perhaps more pertinent for the present investigation is that the Pollard-Gott study provides a potentially useful methodology for studying narrative discourse structure in special populations of readers. For instance, theoretically generated structures should provide a valid comparative base for investigating the subjective organization of narratives for special groups of readers (e.g., hearing impaired readers). This

would not only shed light on the understanding process in special populations, but would also provide an indicant of the universality of narrative schemata.

The purpose of the present study was to compare the subjective story structures generated by hearing impaired college-age students with well known theoretically derived structures and with subjective structures produced by comparable hearing subjects. This was accomplished through partially replicating the Pollard-Gott experiment. In the Pollard-Gott study, undergraduate students were asked to read simple stories and to place the sentences of the stories into clusters that formed cohesive story units. The sentence clusters were subsequently analyzed using hierarchical clustering procedures to provide tree structures representing the generalized subjective story structure (Johnson, 1967). The theoretical structures were generated from two story grammars: one described by Glenn (1978) and one by Mandler and Johnson (1977). The Glenn grammar is typological and categorizes story propositions into six categories: Setting, Event, Internal Response, Attempt, Consequence, and Reaction; the Mandler and Johnson grammar orders story propositions into a hierarchy similar to Thorndyke's (1977). Pollard-Gott reported close agreement between the theoretically derived structures and the subjective ones. Further, they demonstrated that the clustering task used to derive subjective structures was a useful and powerful way to describe the empirical structures.

Obviously, the clustering task is potentially well-suited for use in investigating the subjective story structures of hearing impaired readers. However, we have yet to establish why it is important to study hearing impaired readers from within the proposed framework.

Let us now consider this issue. Whle hearing impaired readers have long been noted as constituting a group of problem or substandard readers (cf. Knight, 1979), evidence from several recent sources indicates that hearing impaired readers process print in essentially the same fashion as do hearing readers. Brewer, Caccamise, and Siple (1979) found that deaf adults with high level English skills showed the same semantic integration capabilities as did hearing subjects when they replicated the Bransford and Franks (1971) study. Along a similar line, Kluwin, Getson and Kluwin (1978) and Kluwin and Kluwin (1979) demonstrated striking similarities in the ways that hearing and hearing impaired adolescents interpreted ambiguous paragraphs. Finally, Ewoldt (in press) has postulated that deaf children process print in a manner similar to hearing children, based on her error analysis of story retelling by deaf subjects. However, these studies remain far from conclusive and the deficit in the reading achievement of deaf students persists.

Reasons for this depressed reading achievement could lie in the notion of memory schema for stories. That is, memory schemata for stories (subjective narrative schemata) have not been directly investigated with deaf subjects. It could be that reading achievement is depressed for deaf subjects because they activate narrative schema at some point different in the reading process, that the narrative schema are construed differently or immaturely, or that narrative schema are not involved in processing print, when compared with hearing subjects. The present study investigated these possibilities although the expectation was, as the literature suggests, that in a clustering task like the one described by Pollard-Gott, hearing impaired subjects should display

basically the same subjective story structures as those displayed by hearing subjects vis a vis the theoretically derived structure.

METHOD

Subjects and Materials

Fifty-two hearing impaired students enrolled in a college for the deaf participated in the study. Four simple narratives were used in the experiment: Boy, King, Farmer, and Peter (short version). These stories were taken without modification from the Pollard-Gott study. Each story had been edited so that the proposition boundaries corresponded to a single sentence. The four stories were arranged in a booklet so that a story in paragraph form appeared first, the same story in sentence list form appeared second, and a blank sheet for grouping the sentences appeared last. The order in which the stories appeared in the booklet was counterbalanced.

Procedure

The stories were presented to subjects in four different English classes. The subjects were instructed to read each story carefully, sort the sentences into groups that made up parts of the story, and to work on only one story at a time. In addition, the subjects were advised that (a) each sentence could only be used once, (b) sentences next to each other on the list do not necessarily have to be grouped next to each other on the blank page, (c) some groups may contain a single sentence, and (d) they could form as many or few groups as they liked except that they could not form only one group. The subjects formed sentence groups by writing down the sentence number and drawing

a circle around the sentence nubmers that formed a group. All instructions and discussions between the experimenter and the subjects were conducted using sign language. The subjects worked at their own pace and typically finished sorting the sentences from the four stories in 25-30 minutes.

RESULTS

Each of the four stories was analyzed in a fashion identical to that reported in Pollard-Gott. While the reader is referred to the Pollard-Gott article for more detail, the basic elements of the analysis are explicated here.

First, the basic unit of analysis was the relatedness score. This score was tallied for each sentence pair in a given story by counting the number of subjects that included the pair in a cluster. The assumption here was that sentence pairs clustered by more subjects are more strongly related than sentance pairs clustered by fewer subjects.

Second, the resultant relatedness matrix was analyzed by hierarchical cluster analysis (cf. Johnson, 1967). This procedure produces a tree structure of progressively larger, related clusters. Two methods may be employed to derive cluster solutions: the single-link or connectedness method and the complete-link or diameter method. The single-link method produces solutions in which sentences are included in the cluster if they are highly related to <u>any</u> of the sentences in the cluster. The complete-link method produces solutions in which sentences are included in a cluster only if they are highly related to <u>all</u> sentences in the cluster.

While both methods were used in this study, only the solutions resulting from the complete-link method are reported as was the case

in Pollard-Gott. In actuality, the single and complete-link method solutions were very similar. However, the complete-link solutions yielded slightly better fits and were perhaps conceptually more appropriate than the single-link solutions (cf. Friendly, 1976).

Third, two statistics were used to evaluate the complete-link solutions.[3] One statistic, Δ, evaluated how well the tree structures fit the input data. The Δ value is inversely proportional to goodness of fit and Friendly (1976) specified that values below .100 indicate good fits.

The second statistic, $Z_{k,\,n}$, represents a pseudo-Z score that evaluates whether the sentences in a cluster represent a true cluster or merely a random clustering of elements. The higher the value of $Z_{k,\,n}$ the better the probability that the sentences form a true cluster. Although the sampling distribution for $Z_{k,\,n}$ is unspecified, Fillenbaum and Rapport (1971) derived a Z value of 4 as a basis for rejecting the hypothesis that the sentences represent a random clustering. As this value is probably very conservative and as our results showed several clusters that approached a Z-value of 4, we have reported Z values of 3.0 and greater. (See note on Figure 1).

The results of the cluster analysis are reported in turn for each of the four stories investigated in this study. Our solutions are compared to those found by Pollard-Gott for hearing subjects and to the theoretical structures provided by Glenn (1978) and Mandler and Johnson (1977). Details for interpreting the figures are given in an explanatory note at the bottom of Figure 1.

Solutions were obtained for two groups of hearing impaired subjects:

one group combining all 52 subjects and one subset of 35 deaf subjects (36 for the Boy Story) with hearing losses of 85 dB or greater in the better ear. The 85 dB criterion insured greater homogenity of subjects in the deaf subgroup and has been discussed by Conrad (1979) as demarking the cutoff for potential processing differences between deaf and hearing subjects. Consequently, if differences in subjective story structures between deaf and hearing subjects do, in fact, exist, they would most likely be found in this group. Consequently, only the results for the deaf subgroup are reported here although the solutions obtained for the full group and for the deaf subgroup were quite similar.

Peter Story

(Short Version)

Table 1 presents the text of the Peter Story and Figure 1 presents the solution for deaf subjects, the solution reported by Pollard-Gott for hearing subjects, and Glenn's (1978) categories.[4] The Δ = .041 for deaf subjects indicated an excellent fit of the tree structure to the input data. Although agreement was evidenced by all three representatives of simple story structure, several potentially interesting differences may be pointed out.

One difference is that sentence 16 clusters significantly with sentences 12-15 for hearing subjects. Apparently, hearing subjects find sentence 16 most appropriately placed as the terminus of the Attempt category while deaf subjects place it so as to initiate the Consequence category as does the Glenn grammar. However, hearing subjects cluster sentence 20 with sentences 16-19 (Consequence) although non-significantly.

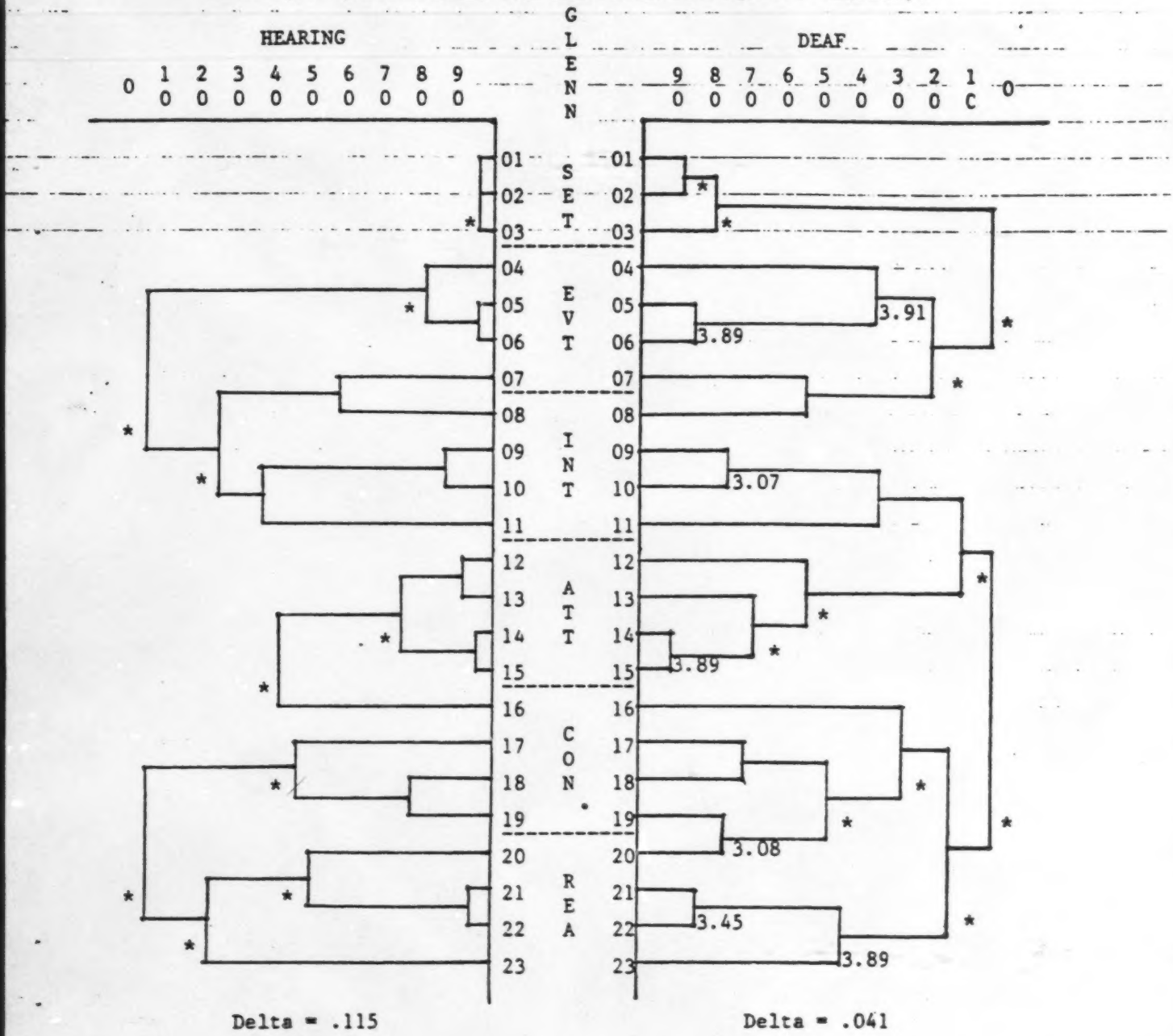
Table 1. PETER STORY (SHORT VERSION)

1.	This is a story about a boy.
2.	His name is Peter.
3.	He lived on a big farm.
4.	One day Peter was playing in the yard.
5.	The mailman drove up in his truck.
6.	The mailman gave Peter the newspaper.
7.	In the paper Peter saw a story about a circus.
8.	Peter got very excited.
9.	He had heard that circuses had trained lions.
10.	He knew there were clown acts too.
11.	Peter decided that he really wanted to go.
12.	He packed a picnic lunch.
13.	He started off for town.
14.	He walked through the cow pasture.
15.	He followed a path by the stream.
16.	A couple hours later, Peter got to the circus.
17.	The first thing Peter saw was the lion show.
18.	Then he saw the clown act.
19.	The clowns were squirting each other with water pistols.
20.	Peter thought that the clowns were funny.
21.	He decided that the lion show was his favorite.
22.	He thought that the lion tamer was very brave.
23.	Peter was happy with everything he saw.

Another difference is found in the higher levels of the tree structure. Deaf subjects group the cluster 9-11 (Internal Response) with the cluster representing Attempt (12-15) while hearing subjects group this same cluster with the Event cluster. However, both hearing and deaf subjects define the Internal Response cluster as sentences 9-11 while Glenn specifies sentences 8-11 in that category.

At the top most levels of the tree structure other differences are in evidence. The deaf subjects produced two major top level structures; one consisting of the (1) Setting and Event categories and one consisting of the (2) Attempt, Internal Response, Consequence, and Reaction categories. Hearing subjects on the other hand produced four major top level structures: (1) Setting, (2) Event and Internal Response, (3) Attempt, and (4) Consequence and Reaction. If the very top most relations are removed from the deaf subjects solutions, however, the major clusters become:

FIGURE 1. CLUSTERING DIAGRAM FOR DEAF AND HEARING SUBJECTS AND GLENN'S(1978) CATEGORIES FOR THE PETER STORY(SHORT VERSION).



NOTE: The Glenn(1978) categories are as follows: Setting, Event, Internal Response, Attempt, Consequence, and Reaction. The top axis represents % of subjects and the vertical axis represents sentence number(see Table 1.). Thus, sentences 1 and 2 were paired by at least 89% of the deaf subjects, 5 and 6 by at least 86% of the deaf subjects, and so on. An '*' indicates a significant 'z' and a number in that position indicates $3 \leq z < 4$. Thus, sentences 1 and 2 clustered significantly for deaf subjects and sentences 5 and 6 clustered at z = 3.89. The data for hearing subjects was reported in Pollard-Gott, McCloskey, and Todres(1979).

(1) Setting, (2) Event, (3) Event and Internal Response, (4) Consequence and Reaction which more closely parallels the solution for heaing subjects.

Comparisons of the internal structure of each of these major clusters for deaf and hearing subjects reveals some additional potentially interesting differences. The Setting cluster (1-3) was formed 1, 2, 3 (sig.) for heaing subjects and 1, 2 with 3 (sig.) for deaf subjects. The Event category was different for the two groups of subjects. Hearing subjects clustered 4 with 5, 6 (sig.) while deaf subjects clustered 4 with 5, 6 (sig.) and 4-6 with 7, 8 (sig.). The Internal Response category for heaing subjects clustered 9, 10 with 11, and then 7, 9 with 9-11 (sig.). Then it clustered significantly with the Event category. Deaf subjects, clustered 9, 10 with 11 for the Internal Response category. The Attempt category for hearing subjects was formed by clustering 12, 13 with 14, 15 (sig.) and then 12-15 with 16 (sig.). For the deaf subjects the Attempt category was formed by clustering 13 with 14, 15 (sig.), 12 with 13-15 (sig.) and then clustering back to the Attempt category (sig.). The Consequence category for hearing subjects clustered 17 with 18, 19 (sig.) while for deaf subjects it clustered 17, 18 with 19, 20 (sig.) and 16 with 17-20 (sig.). The Reaction category consisted of 20 with 21, 22 (sig.) and 20-22 with 23 (sig.) for hearing subjects. Deaf subjects produced a Reaction category of 21, 22 with 23 (near sig.). In both the hearing and deaf groups the Reaction category clustered with the Consequence category significantly.

It would seem that while major clusters are produced by each group that roughly coincide with Glenn's story categories, the way in which

the clusters are formed and their specific boundaries are somewhat different for the Peter Story.

King Story

The results of the cluster analysis are presented in Figure 2 and the text of the King Story is presented in Table 2. The cluster solution for this story yielded $\Delta = .042$ which again indicates an excellent fit between the solution and the input data. A comparison of the subjective structures produced by deaf and hearing subjects and the structure produced by Mandler and Johnson's grammar shows them all to be quite similar.

As in Mandler and Johnston, and in the structure for hearing subjects, the deaf subjects produced three major clusterings of sentences. However, these three major clusters were not identical and exhibited some interesting contrasts.

Table 2. KING STORY

1.	Once there was a king.
2.	The king had three lovely daughters.
3.	One day the three daughters went walking in the woods.
4.	They were enjoying themselves very much.
5.	They lost track of the time.
6.	They stayed too long in the woods.
7.	A dragon appeared.
8.	He kidnapped the three daughters.
9.	As they were being dragged off they cried for help.
10.	Three heroes heard their cries.
11.	They set off to rescue the daughters.
12.	The heroes reached the scene.
13.	They fought the dragon.
14.	They killed the dragon.
15.	They rescued the maidens.
16.	The heroes returned the daughters safely to the palace.
17.	The king heard of the rescue.
18.	He rewarded the heroes.

Pollard-Gott had noted that the subjective story structure for hearing

FIGURE 2(a). CLUSTERING DIAGRAM FOR DEAF AND HEARING SUBJECTS FOR THE KING STORY.

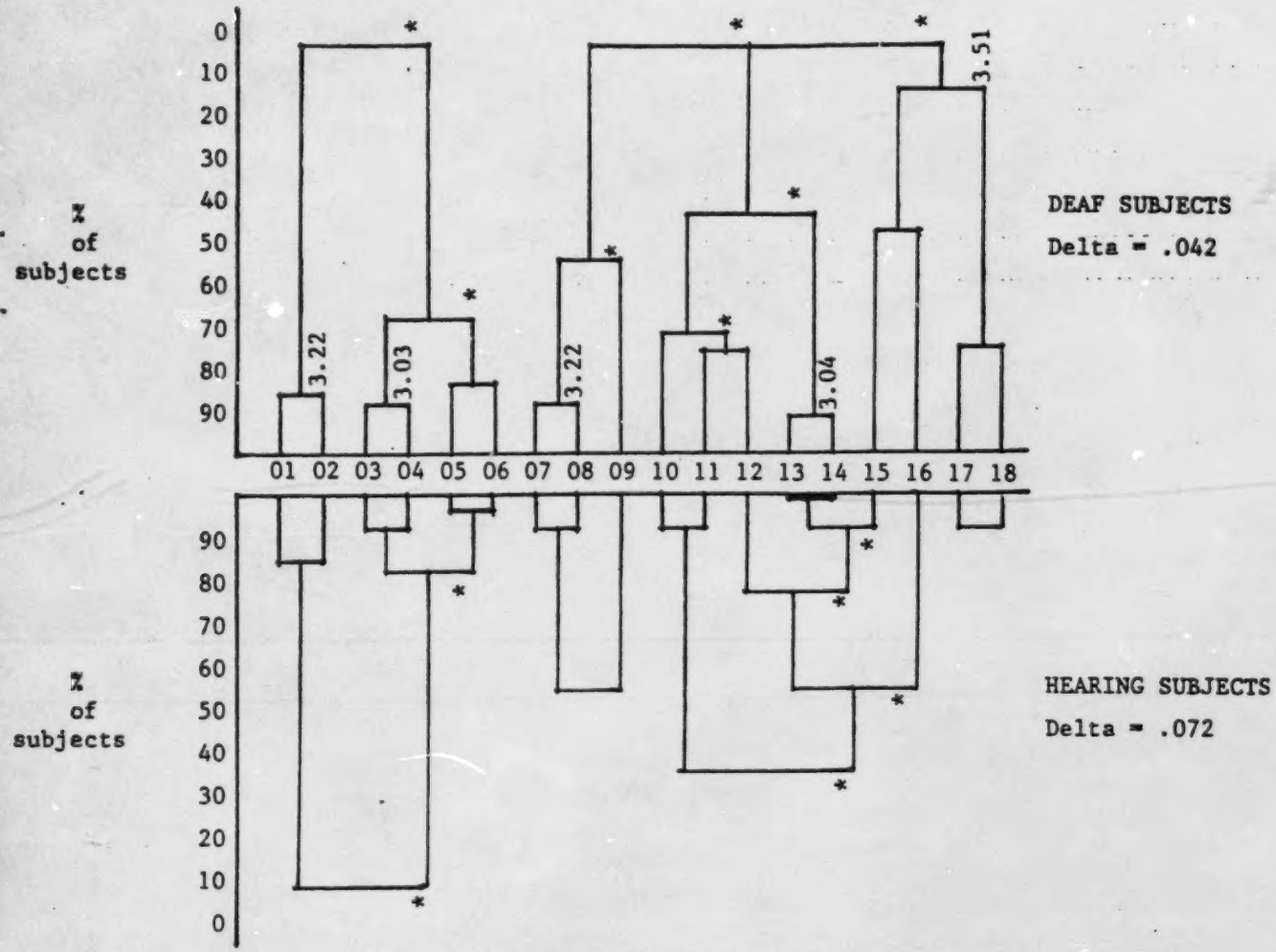
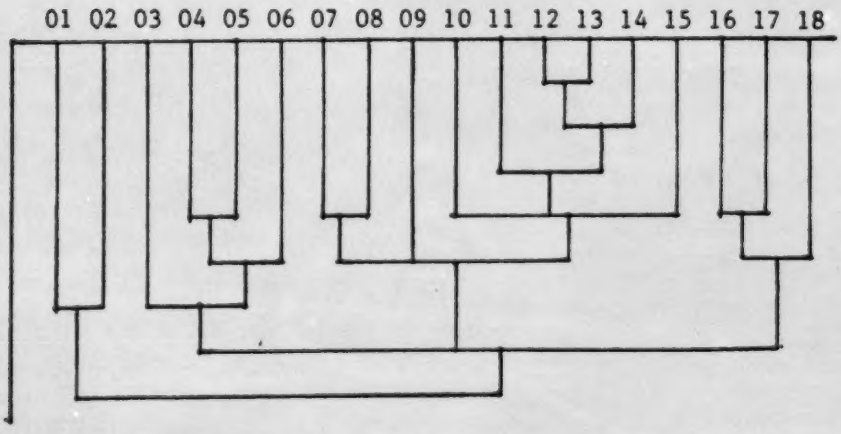


FIGURE 2(b). MANDLER AND JOHNSON'S(1977) TREE STRUCTURE FOR THE KING STORY.



NOTE: The vertical axis for the theoretical(Mandler and Johnson) structure has no scalar value but rather represents a physical dimension necessary to visually display the hierarchy of clusters.

subjects had shown certain differences with the Mandler and Johnston structure. Basically, Pollard-Gott defended the subjective story structure produced by their hearing subjects as being a more natural grouping of sentences. A major requirement of Mandler and Johnson's grammar is a well defined Beginning, Development, and Ending for each episode. This requirement may force sentences into structures that would not occur under less constrained situations. Consequently, subjective structures such as those produced by Pollard-Gott's subjects at least represent a reasonable alternative structuring of story elements. For example, sentence 16 could represent the final action in the rescue episode (subjective structure) as well as initiate the final episode (as in Mandler and Johnson).

Although the deaf subjects closely paralleled the hearing subjects in the beginning and mid sections of the story, the latter part of the story structure differed to a larger extent. The deaf subjects clustered sentences 15-18 in the concluding episode, Mandler and Johnson clustered 16-18, and the hearing subjects clustered 17-18. The deaf subjects initiated the final cluster representing the return of the maidens and the rewarding of the heroes with sentence 15 ('They saved the maidens'). It is hard to isolate a good rationale for including sentence 15 with the return and reward episode. It seems much more defensible to cluster sentence 15 with the preceding sentences (10-14) detailing the rescue episode. However, sentence 15 did not cluster with sentences 16-18 significantly for the deaf subjects, so any conclusions at this point must remain tenuous.

In addition to these differences, the manner in which the sentences were combined from sentence 10-18 is interesting. The deaf subjects clustered 10 with 11, 12 (sig.), 10-12 with 13, 14 (sig.0, 15, 16 with

17, 18, and 10-14 with 15-18 (sig.). Hearing subjects clustered 13, 14 with 15 (sig.), 12 with 13-15 (sig.), 12-15 with 16 (sig.), 10, 11 with 12-16 (sig.) and 17 with 18. Mandler and Johnson's grammar clustered 12, 13 with 14, 11 with 12-14, 10 and 15 with 11-14, and 16, 17 with 18. Although major cluster boundaries were appropriately maintained in the earlier parts of the story, the latter parts were not as similar and the internal structure of clusters seemd to show a different organization between deaf and hearing subjects and the theoretical structure.

Farmer Story

The Farmer Story cluster solutions are presented in Figure 3 and the story propositions are listed in Table 3. The cluster solution for deaf subjects produced a $\Delta = .051$ indicating yet another excellent fit. Examination of the cluster solutions in Figure 3 shows that the deaf subjects produced major clusters that were identical to the hearing subjects but which differed somewhat from Mandler and Johnson's structuring of the story.

Both deaf and hearing subjects produced clusters of sentences 1-7, 8-10, and 11-16. Some differences are evident within those clusters. For example, hearing subjects cluster sentences 5 and 6 out of sequence and cluster 8-10 attaches to 1-7 for deaf but not for hearing subjects. However, the two solutions remain remarkedly similar in terms of the external boundaries of the major episodes.

Mandler and Johnson's grammar produces a neat right branching tree structure for the Farmer Story. However, as Pollard-Gott points out, the subjective structure produces three basic episodes: sentence 1-7 describe the farmer's initial failure to get the donkey into the barn,

sentences 8-10 describe a second abortive attempt, and sentences 11-16 describe the final events culminating in the donkey entering the barn. Pollard-Gott concluded that the subjective organization of such a story might not be as tight as the theory would specify. Certainly the fact the deaf subject's clusters closely mirrored the hearing subject's subjective organization would strenghten this conclusion.

Table 3. FARMER STORY

1.	There once was an old farmer.
2.	He owned a very stubborn donkey.
3.	One evening the farmer wanted to put his donkey into the barn.
4.	First he pushed him.
5.	The donkey would not move.
6.	Then he pulled him.
7.	The donkey still would not move.
8.	Next the farmer thought he could frighten the donkey into the barn.
9.	So he asked his dog to bark at the donkey.
10.	The lazy animal refused.
11.	Then the farmer thought that his cat could get the dog to bark.
12.	So he asked the cat to scratch the dog.
13.	The cooperative cat scratched the dog.
14.	The dog immediately began to bark.
15.	The barking frightened the donkey.
16.	The donkey jumped into the barn.

However, Pollard-Gott also maintained that the hearing subject's clusters easily translated into right branching clusters. Examination of Figure 3 shows this to be the case. But the deaf subject's cluster solution did not display this right branching tendency. That is, the outer boundaries of the clusters were the same but the internal organization of these same clusters was different in each case.

For example, cluster 8-10 was formed by clustering 8 and 9 with 10 for hearing subjects but was formed by clustering 8 with 9 and 10 for deaf subjects. Both clusterings differed from the relationship specified for sentences 8-10 by Mandler and Johnson. Similar contrasts were found for sentences 3, 5, 6, and 13. However only sentence 13 clustered sig-

FIGURE 3(a). CLUSTERING DIAGRAM FOR DEAF AND HEARING SUBJECTS FOR THE FARMER STORY.

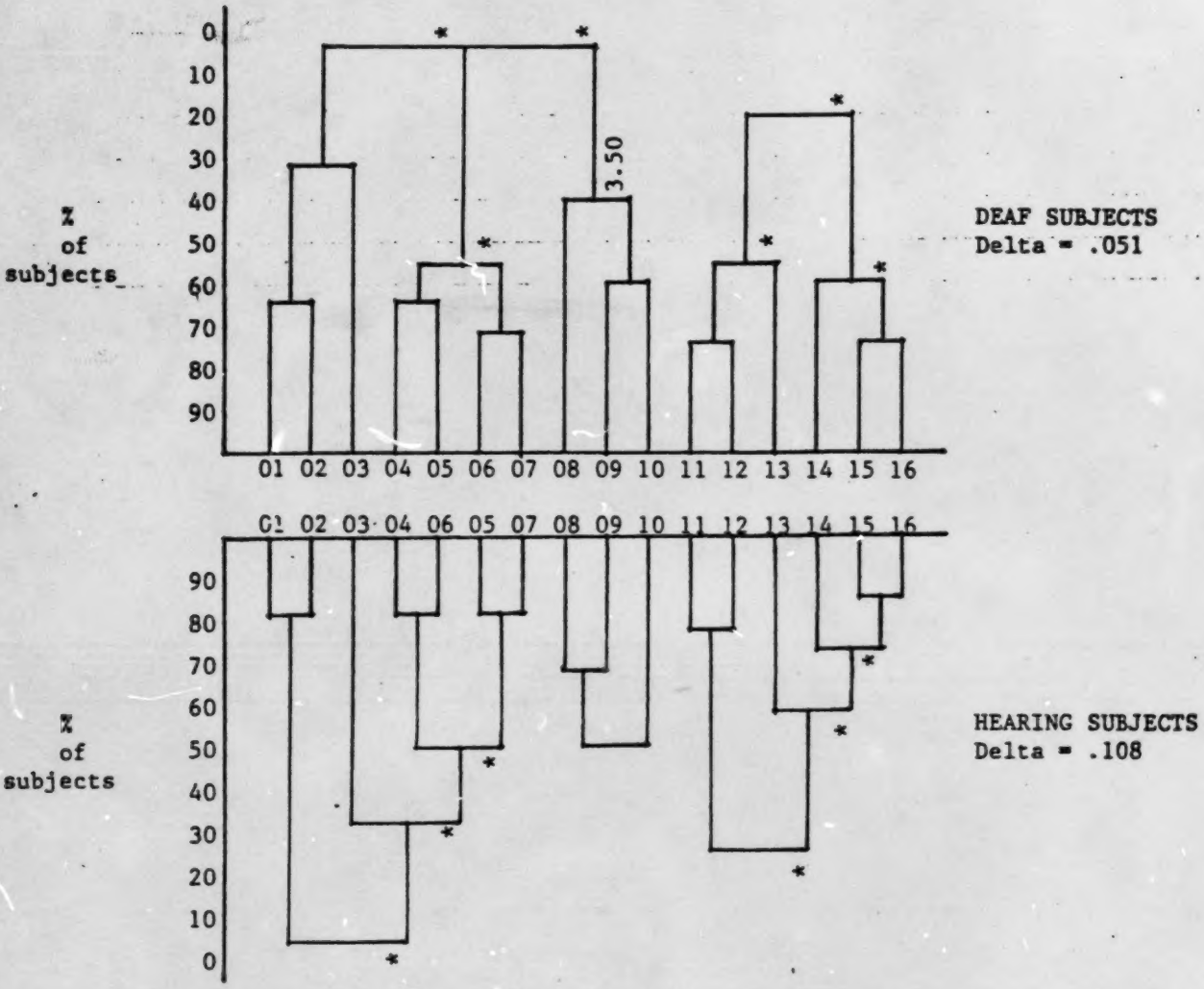
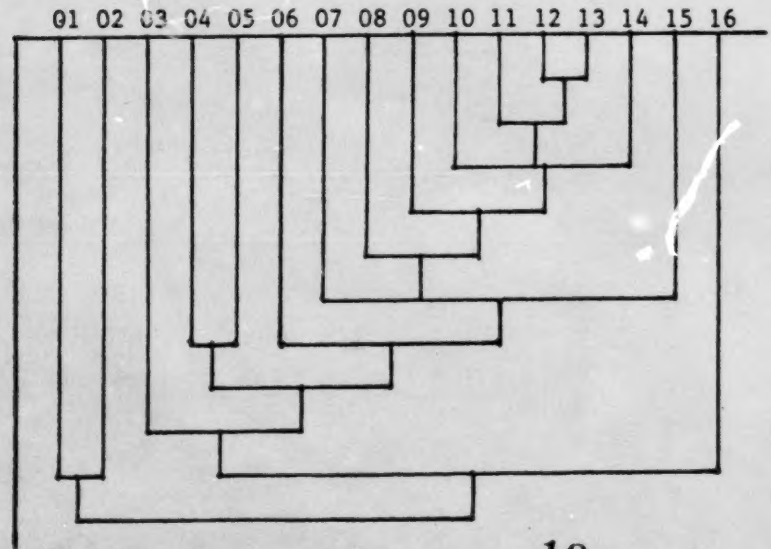


FIGURE 3(b). MANDLER AND JOHNSON'S(1977) TREE STRUCTURE FOR THE FARMER STORY.



nificantly for the deaf subjects although sentence 8 approached a significant clustering. Consequently, it cannot be expected with any great certainty that these potentially provocative differences would replicate.

Boy Story

The cluster solutions for the Boy Story are depicted in Figure 4 and the text for the Boy Story is presented in Table 4. The fit of the solution for the deaf subjects was $\Delta = .052$. This excellent fit indicated that the deaf subjects had a high level of agreement among themselves on the sorting task. Such was not the case with the hearing subjects in the Pollard-Gott study, however.

The Boy Story consists of two symmetrical episodes with a common setting statement according to Mandler and Johnson. While approximately half of Pollard-Gott's subjects (Group I) produced this structure another subset of nine subjects (Group II) produced a structure that clustered the common elements across the episodes. For example, sentences 3, 4, 11, and 12 were clustered because 11 and 12 represent the same function in the second episode as 3 and 4 did in the first episode.

However, the deaf subjects appeared not to utilize this alternative structure as the Boy Story solution for them closely followed that of the two separate episode organization. Also the very good fit of the tree structure to the input data would preclude any major disagreement among the deaf subjects. Consequently, only the Group I solution from Pollard-Gott is presented for comparison here.

Reviewing this comparison in Figure 4 reveals a situation similar to that noted for the Farmer Story. That is, the external boundaries of clusters are the same but the internal organization of the clusters

differs between the deaf subjects, the hearing subjects, and the theoretical structure.

Table 4. BOY STORY

1.	There once was a little boy.
2.	He lived in a very hot country.
3.	One day his mother told him to take some cake to his grandmother who lived nearby.
4.	She warned him to hold the cake very carefully so it would not break into crumbs.
5.	The little boy wrapped the cake up in a leaf.
6.	He tucked the cake under his arm.
7.	He carried the cake to his grandmother's house.
8.	When he got there the cake had all crumbled into pieces.
9.	His grandmother told him he was a silly little boy.
10.	She said that he should have carried the cake on top of his head so that it wouldn't break.
11.	She gave him a pat of butter to take back to his mother's house.
12.	The little boy wanted to be very careful with the butter.
13.	He put the butter on his head.
14.	He carried the butter home.
15.	The sun was hot.
16.	When he got home the butter was all melted.
17.	His mother told him he was a silly little boy.
18.	She said that he should have wrapped the butter in a leaf so it would have gotten home safe and sound.

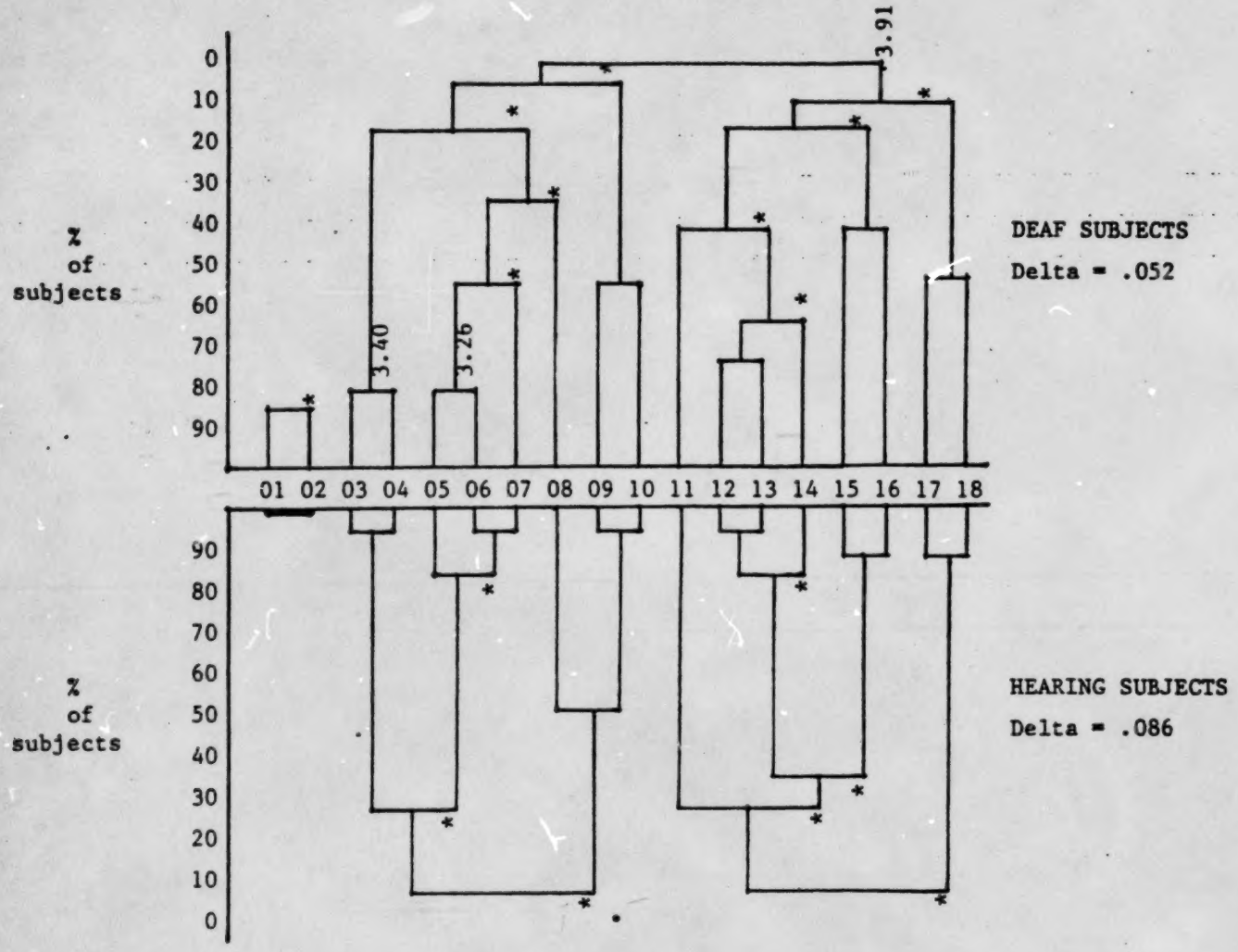
For example, within the episode 3-10 the deaf subjects clustered 5, 6 with 7 (sig.), 5-7 with 8 (sig.), 5-8 with 3, 4 (sig.), and 3-8 with 9, 10. The hearing subjects, however, clustered 5 with 6, 7 (sig.), 5-7 with 3, 4 (sig.); 8 with 9, 10, and 3-7 with 8-10 (sig.). Mandler and Johnson's grammar clustered 5-7 with 8, and 3, 4 with 5-8 with 9, 10. A similar, though not as pronounced, contrast can be found by viewing the second episode in Figure 4.

It would appear that the results from the Boy Story indicate that some replicatable differences within the episodic structure exist between deaf subjects, hearing subjects, and the theoretical story structure.

DISCUSSION

The subjective story structures generated by deaf subjects have shown both similarities and differences when compared with the subjective

FIGURE 4(a). CLUSTERING DIAGRAM FOR DEAF AND HEARING SUBJECTS FOR THE BOY STORY.



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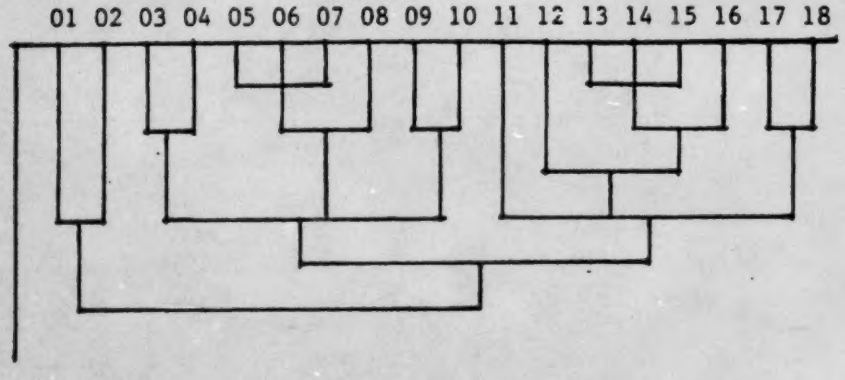

story structures generated by hearing subjects and with theoretically derived structures. The similarities, in large part, regard the outer boundaries of major clusters. The differences, on the other hand, largely pertain to the internal structuring of the major clusters. Each bears closer inspection in turn.

First let us examine the similarities. Both the Farmer Story and the Boy Story showed quite consistent similarities in the outer boundaries of major clusters in both the deaf and hearing solutions. The episodic structure of both these stories was essentially the same for both groups. Although the subjective story structures differed from the theoretical structures, they did so for easily justifiable reasons (c.f. Pollard-Gott, McCloskey, and Todres, 1979).

The King and Peter Stories, while showing similarities between the outer boundaries of major clusters, did not do so as consistently as in the previous two stories. The King Story maintained some cluster boundaries for both groups until the rescue episode was initiated in sentence 10. Then, the subjective structures for both groups and the theoretical structures presented different boundaries for the remaining clusters.

In the Peter Story the similarities in the major boundaries between deaf, hearing and theoretical structures stop after the Setting cluster. That is, in all of Glenn's (1978) six categories only one is supported by both deaf and hearing subjects. The remaining five categories (Event-Reaction) show disagreements in the outer boundaries of major clusters between deaf and hearing subjects in every case.

These dissimilarities between the deaf, hearing and Glenn structures

was most typically in the placement of one sentence or proposition. For example, one group of subjects would use a given sentence to close or complete a given cluster, while the other group would use the same proposition to initiate the subsequent episode. Unfortunately, no one group consistently used a sentence to close an episode while the other group used it to open the ensuing episode. Consequently, no patterns were immediately discernable.

However, the Peter Story itself may account for some of these problems. It was the only story of the four in which the Glenn grammar was employed. It was the only story that was created by the grammar rather than parsed by it. That is, each sentence in the story was created to fit one of the six Glenn categories. Consequently, the Peter Story has a relatively high potential for being contrived. While the categories themselves appear to be valid (both subjective structures were comprised of six major clusters), the exact boundaries of the categories as set forth by Glenn, may not be so.

Second, let us examine more closely the internal structuring of the major clusters. Summaries of the internal organization of the major structures can be obtained by rereading the final paragraphs of each story report in the results section. Although, the preceding discussion pointed up some dissimilarities in outer boundaries, these summaries point up differences in the internal organization of the major clusters for deaf and hearing subjective structures and empirical structures, in almost every case. While not all the differences occur between clusters with significant Z values, enough do occur to demonstrate that the internal organizations of the major clusters do differ between deaf, hearing and

theoretically derived solutions.

Consequently, the results are not as conclusive as was originally hoped. On the one hand (particularly for the Farmer, Boy and King Stories) we have shown evidence that strongly suggests the universality of the narrative schema. Here, both deaf and hearing subjects produced almost identical subjective story structures that matched rather nicely the theoretical structures (or differed from them in justifiable ways). On the other hand our results also show differences: (a) in the outer boundaries of some of the major clusters in the King Story and almost all of the major clusters in the Peter Story, and (b) in the internal organization within a large proportion of the major clusters in all of the stories.

Perhaps these differences do not represent true differences. However, the "goodness of fit" of the cluster solutions for deaf subjects was better than that for hearing subjects in every case. In addition, deaf subjects produced more significant Z values for clusters than was produced by hearing subjects. This fact would indicate a higher proportion of clusters replicating for deaf subjects than for hearing subjects. Consequently, it is felt that the differences shown in our results merit consideration as true differences, for the most part.

Given that these differences are true ones, what ramifications do they hold for deaf subjects when processing print? That is, are these findings indicative of different processing and/or narrative schemata in deaf subjects? Our data would appear to support the following in this regard.

First, deaf readers do appear to employ an internal structure or organization consistent with that expressed by hearing subjects and

by theoretically derived structures. If one sets aside the results for the Peter Story, for what we feel are defensible reasons, then the outer boundaries of the major clusters are identical for deaf and hearing subjects for all but the latter episodes of the King Story. These latter episodes were construed differently from the Mandler and Johnson version in both the deaf and hearing subjective structures. This could indicate that these final episodes exhibit fuzzy boundaries, as was suggested by Pollard-Gott, and as a consequence one would not expect identical outer boundaries to obtain. In any event, our data support, with some qualification, the universality of narrative schemata in the reading process.

Second, although deaf and hearing subjects appear to share similar outer boundaries for the major clusters, the internal organization of those same clusters appears to be different. This factor was demonstrated rather amply earlier in this section and research showing cross-cultural story schemata differences provides a possible explanation for this occurence. It could be that deaf children grow and develop in a culture different from hearing children and that their set of life experiences and communication difficulties could cause differently organized narrative schemata to develop. The notion of the deaf living in both a hearing and deaf culture has been forthcoming for some time (Stokoe, 1976; Markowicz and Woodward, 1975; Padden and Markowicz, 1975) so a certain level of credence accrues to this possible explanation.

What other factors would require examination and explanation before our results could be considered conclusive? At least two factors come immediately to mind.

Firstly, a major assumption necessarily underlies our comparison of deaf subjects with hearing subjects and the empirical structures. Thus far we have assumed that agreement in major cluster boundaries implies similarity of meaning and function of those major clusters between the deaf and the hearing subjective structures and the theoretical structures. While this could well be, our data do not directly comment on it.

Secondly, our accounting of the data could reflect our biases and the simplest explanation of all would be that the results are artifactual to the sorting task itself. That is, it could be that the results are due to relative simplicity of the task and of the underlying structure. For example, while propositions clustered sequentially (e.g. 1 with 2; 3, 4, with 5) rarely was the natural sequence of propositions altered in the clustering task (e.g. 1 with 4; 2, 3, with 5). The simple, sequential nature of the task coupled with some as yet undetected salient feature of the propositions could also account for the results of our study. Additionally, it was not necessary for subjects to process and comprehend the propositions in the stories at any depth, in order to complete the sorting task. Thus, our data do not comment on whether the major clusters obtained in the subjective structures are actually used by subjects in processing and comprehending print.

As a result of these factors two additional studies are nearing implementation. One study will utilize the sorting task to cluster propositions presented to subjects in scrambled order. This would force subjects to process the propositions at a deeper level and lessen the likelihood that the results are artifacts of the task. A second study will have subjects sort the sentences into clusters and then provide

a title for each cluster. This task should also force deeper processing of the propositions as well as illuminate the meaning attached to the clusters by the subjects.

We regard the results of our study as a first step in defining a research area focusing on schemata and prose learning in both general and deaf populations. Many unanswered questions are evident and many interesting and provocative questions remain to be broached. However, as the processing of print has remained an unresolved focal problem in the Education of the Deaf since its inception, it is well worth all the attention we can give it.

Reference Notes

1. The authors wish to thank Robin Kranz, Michael McCloskey, Lawrence Rudner, and Ron Reed for their support and assistance in completing this study.

2. Due to the repetitious referencing of the Pollard-Gott, McCloskey and Todres (1979) article the citation will be reduced to "Pollard-Gott" for the remainder of the paper.

3. Formulas for these statistics are available in Pollard-Gott, McCloskey and Todres (1979). Computer programs for computing the statistics are available through the authors.

4. All data pertaining to hearing subjects was obtained from the Pollard-Gott, McCloskey and Todres (1979) article.

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